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FOREST SERVICE

BRANCH OF RESEARCH

MONTHLY REPORT

OF

FOREST EXPERIMENT STATIONS

FOREST PRODUCTS

FOREST ECONOMICS

RANGE RESEARCH

JAN 1932



747244

BRANCH OF RESEARCH

JANUARY, 1932

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APPALACHIAN FOREST EXPERIMENT STATION

Forest Management in North Georgia

Computations of volume and volume growth were completed for the woodlands of the Georgia Mountain Experiment Station. These figures, besides contributing to the general growth study, will form the basis for a management plan under which the Georgia Experiment Station proposes to regulate the woodlands at its mountain branch.

Barrett, C. A. Abell, and M. S. Abell marked a 17-acre compartment of this woodland for a fuelwood cutting. All marked trees were measured in order that the ratio may be obtained between estimated cubic volume and stacked cords.

Rodent damage, killing less than 0.5 per cent of the trees, was found on two white pine plantations set out last November in old fields with 2-0, grade 1 stock. Losses on a 1.2 acre underplanting with Grade 2 stock amounted to 4.5 per cent dead and 1 per cent bitten off by rodents.

Last April two reproduction strips, each 10 links x 3 chains, were established in a recently logged hardwood area adjacent to an excellent old field stand of Virginia pine. The strips, run at right angles to the edge of the old field, each contained 30 milacres which were tallied separately. In January examination revealed an increase of 883 pine seedlings per acre since the previous April.

Forest influences

Several field trips were made over the Bent Creek area for the purpose of observing surface run-off and ground water movements from road cuts. Hursh spent most of the month in the office revising the working plan for the project and organizing the report on humus layers of the mountain forest cover types as effected by fire and cutting and their relation to water conservation. A conference was held with Professor Thorndike Saville, of the State Department of Conservation and Development, about the water relations investigation being carried on by the State.

Management of loblolly pine

The study of the relative effects of the several factors governing increase in growth of loblolly pine trees left after partial cutting is being carried on by MacKinney in Washington. Results to date are vague and questionable, probably because of the many factors operating and the relatively small effect of any one of them.

(Over)

Preliminary analysis has shown that we have no satisfactory method of evaluating competition or release from competition in forest stands. The difficulty of predicting the probable growth rate of the study trees, had they not been released, was increased by lack of information on the basal area growth of lower crown class trees in forest stands. Tentatively the growth for the five year period before cutting will be used as an index.

Fire damage

The annual determination was made of the amount of litter on four one-half acre plots in a pine-oak stand at Bent Creek. One of the plots was burned in the spring of 1930, on one the litter is raked off every year, and the other two have had no treatment. Litter per acre was estimated from measurements on twelve selected milacres on the raked plot and six selected milacres on each of the other three. On an acre basis it was estimated that there were 13,000 pounds of litter on untreated plots, 7,300 pounds on the burned plot representing two years' fall, and 3,700 pounds on the raked plot resulting from one year's disposition. Although the method of sampling is not entirely satisfactory, the estimated leaf fall on the raked plot was one-fourth greater in 1931 than in 1930.

Biological Survey

In December a comparative study of wild life was initiated on unburned and recently burned areas. Two pairs of half-acre plots were established - one burned and one unburned plot - on a northerly slope and a similar pair on a southerly slope. All are at approximately 4,000 feet elevation on Rocky Knob, which is partially in the Pisgah National Forest. The two unburned areas are being intensively trapped to determine the normal rodent population. A study will be made of the predatory birds and mammals present because of their bearing on the rodent population.

Burleigh spent practically the entire month of January in the field. The first ten days were given to a general investigation of the status of waterfowl in southwestern Georgia and northwestern Florida. The following week a detailed study was made of the recently created Migratory Bird Refuge at St. Marks Lighthouse on the Gulf Coast of Florida. Three days were devoted to a study of wild life on Blackbeard Island near Darien, Georgia, which is a wild life sanctuary administered by the Biological Survey.

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CALIFORNIA FOREST EXPERIMENT STATION

General

The annual meeting of the regional Investigative Committee in San Francisco was a most vigorous and successful one. The attendance averaged about 40. A feature of the meeting was the presentation of material aided by charts, lantern slides and other visual aids.

Forest Management - Pine Region

In the Mc study the completion of most of the progress reports for the 20-year plots brings out several points, all interesting but suggesting a discouraging volume of work still ahead.

The net growth for the many plots - nearly 500 acres in all - is rather small. Only 5 plots averaged more than 200 bd. ft. per acre annually. Four exceeded 300 bd. ft., and one exceeded 400 bd. ft. Five plots exceeded one per cent (comp. int.) annually, only 2 exceeded .2 per cent, and only 2 plots show a satisfactory combination of growth in actual board feet and growth per cent. These are Sierra-1 and Sequoia-6, with about 340 bd. ft. and 2.2 per cent each.

Dunning thinks it is evident that these older plots are victims of that prevalent shibboleth "including a good general average of conditions". The several combinations of related factors produce a uniformity of results impossible to interpret or use as a predicting mechanism. How can we measure the influence of the more important variables, such as site index, stocking, tree class distribution, species composition, etc., in terms applicable to stand tables from the cut-over land cruises? Fortunately, we have stand maps for some areas. We can divide those large heterogeneous plots into smaller more uniform series - possibly 500 plots instead of 33 - to show the real range of site index, stocking, etc. But the number of variables is appalling and the ideal combination elusive. The "normal stand" for cut-over areas will probably be taken as the stand giving the best combination of growth in board feet and per cent. As yet this combination is still submerged in the general average.

Progress reports were completed by Hasel and Clements for Mc-Sequoia, Plots 4 and 5 and most of the tables prepared for Shasta Plot 6. Computations were completed and checked, with the exception of volumes, on the Massack Plots of the Plumas. Before computing volumes on those plots it is planned to make a check on height measurements at the beginning of the coming field season. The data on Stanislaus Mc Plots 9 and 10 were compiled on the atlas sheets and the tree sheets for Plot 11 sorted for compilation. Traverse computations for Stanislaus Mc Plots 1, 2, and 4 were completed and plot areas determined.

Forest Management - Redwood

Person and Gibbs made a preliminary summary of some of the results of the planting study and the survey of cutover areas for use in the investigative program. Gibbs continued with the work of coding the field data from the cutover area study and he now has about two-thirds of this material ready for punching on the tabulating cards.

The two most striking results of a preliminary analysis are (1) the fact that under reasonably favorable conditions redwood reproduces readily from seed and (2) the fact that stocking from redwood sprouts has been greatly exaggerated. On the more than 8600 quadrats examined stocking from redwood seedlings amounted to approximately 5.3 per cent compared with 9.3 per cent for redwood sprouts and 6.7 per cent for Douglas fir seedlings. Under very favorable conditions areas were found with over 30 per cent of the milacre quadrats stocked with natural redwood seedlings and on several areas the stocking from redwood seedlings was greater than the stocking from redwood sprouts. The average stocking from all coniferous seedlings on the areas examined totalled approximately 14.5 per cent or one and one-half times the stocking from redwood sprouts. These results are more remarkable in view of the general belief that stocking from redwood sprouts amounts to between 20 and 35 per cent and that stocking from seedlings is negligible.

The planting data supplied by the participating lumber companies and by Mason and Stevens have been summarized. These show that a total of 6,365,000 trees were planted on 25,500 acres at a cost of \$225,000. The costs for Mendocino County averaged \$10.50 per acre and for Humboldt County \$7.32 per acre. Company data show an average survival of 47 per cent which is probably high by at least 7 per cent. Best survival and growth were apparently found on north, east and west exposures, which were planted with 1-1 stock (redwood) within one year after logging.

Cover Types

Status - January 1, 1932

Recently upon receipt of progress reports from all the National Forests the areas completed to date were shown on a map and planimetered. A summary is given herewith in million acre units which automatically indicates per cent.

	Million acres
<u>Total area of State (approx.)</u>	100
<u>Mapping not Required</u> (Desert, agricultural, and urban areas)	44
<u>Mapped</u>	
National Forests	16
*Outside areas (extensive)	8
Outside areas (intensive)	12
<u>Remaining to be Mapped</u>	
National Forest	7
Outside (intensive)	5
**Outside (extensive)	8
Total -	100

*Mapped 1926-1927 extensively and on a different type basis than subsequent work. Remapping recommended upon completion of all other areas.

**Intensive mapping precluded because topographic or other adequate base maps are not available.

Plans for 1932 provide for the completion of about 5 million acres of the remaining National Forest land, of all outside areas that can be intensively mapped, and in addition about 4 million acres where extensive methods must be used.

Eldorado County Land Use Study

That forestry should have an important place in any program of land utilization for this county is indicated by the following summaries of the recently completed compilations of areas from the type site and stocking maps. These data have added significance when it is considered that Eldorado is one of a number of Sierra foothill counties where similar situations exist.

Table 1. - Land Classification

Total area	499,000 acres
Virgin timber	9.1%
Restocking cut-over	32.6
Deforested	31.0
Non-forest lands	24.3
Cultivated	* 3.0
	100.0%

*Over 90% on deforested lands.

Table 2. - Forest Possibilities

: *Yield in 60		: Restocking	: Deforested
Site : years. M Bd.ft. :		Cut-over	: 155,000 acres
Index : Int. 1/8" kerf :		163,000 acres	:
:		%	%
50	24	2.8	22.4
60	35	24.9	52.8
70	50	43.2	20.8
80	69	22.1	3.4
90	88	7.0	0.6
Total		100.0	100.0

*Preliminary yield tables for second growth western yellow pine, by L. H. Reineke, 1931.

The present use for the restocking cut-over and deforested areas is grazing. In a futile attempt to enhance grazing values many of the present owners are resorting to frequent burning, which is adding rapidly to the deforested area. On deforested areas the western yellow pine has been replaced to a large extent by such foot-hill species as Digger pine, blue oak, interior live oak, Ceanothus, and manzanita, which aggressively invade burned timber sites.

Forestation

Southern California is experiencing an unusually wet rainy season, the total recorded at Devil Canyon by January 31 being 21.48 inches as compared with a total of 10.25 inches at the same time last year. Interspersed with the rain have come the usual periods of north

wind - cold, dry and destructive to forest and farm planting alike. One such wind, accompanied by freezing temperatures, constituted a severe test of the "fire-proof" Euphorbias in the nursery. Both Euphorbia laro and E. tirucallii suffered loss of leaves and wilting of all tender parts but E. mauritanica came through quite undamaged.

At Berkeley the "forestation" activities which have occupied part of Ilch's time are the routine germination tests, the starting of plants for use in Lowdermilk's large water-cycle tanks, and the installation of a series of what might be called, for want of any existing name, "nutrient solution seedbeds".

This last is a cooperative experiment undertaken by Kraebel with Ir. W. F. Gericke, of the University Division of Plant Nutrition, who has developed a successful technique for growing vegetables, flowers and even wheat to full maturity without the use of soil. Advantages are the production of very much greater plant material per unit of area and the speeding up of the entire growth process from seed to maturity. Our first interest lay in the possibility of overcoming some of the chronic difficulties in growing sugar pine, but in the actual installation we have included also ponderosa and Jeffrey pines. The solution "seedbeds", in duplicate, consist of sheet-iron reservoirs 10 inches deep, 30 inches wide and 10 feet long. A standard seedbed in soil was installed at the same time adjacent to the reservoirs for comparison.

Barranca Watershed Study

Experience at the mouth of Barranca Canyon during heavy rains of the present winter has demonstrated the inadequacy of the Parshall flume for measuring flood flows laden with coarse erosion-debris. In the storm of December 28-29, which poured 3.2 inches of rain over the Barranca Watershed, it proved impossible for three men to keep the flume open, so rapidly did the sand and rolling rock accumulate. In less than half an hour the run-off increased from a rivulet 10 inches wide by one inch deep to a torrent 7 feet wide and a foot deep. Clogging was observed to start not in the flume itself but in the approach channel of very low gradient, and about 20 feet long, leading in to the flume. According to the present design and rating of the flume, such an approach channel is essential and when the flume is used with comparatively clear water, as in irrigation ditches, for which it was originally designed, it functions without trouble. But experience at the Barranca installation has several times shown that the slowing down of the water in this channel results in the dropping of the heavier solids at this point and the rapid building up of the channel bed to such a point that when the peak flow arrives it surges out of bounds over the top of the flume. Under these conditions the records obtained by the flume instruments are meaningless, and measurement of the run-off must be calculated from the reservoir gage record.

New deposits in the reservoir from the recent storms have not yet been surveyed but Kraebel roughly estimates them at 150 cubic yards, or approximately 40 times the amount brought down during the entire winter of 1929-1930 when the rainfall to January 31 was only about half that of the present season to the same date. Clearly, if the flume method of measuring flood flows is to be made dependable, the ditch-like approach channel must be dispensed with and replaced by a chute of a gradient steep enough to prevent deposition of eroded material. To such a set-up existing rating tables for the Parshall flumes would not apply, and the installation would require specific calibration. Incentive for the effort to perfect a flume method, as against the impermeable silt-trap reservoir method, is twofold: (1) the more sensitive and direct recording of rate of run-off, and (2) the large savings in cost of installation and maintenance. It is to be hoped that some modification of the flume method or some other satisfactory method of direct measurement of debris-charged flood flows can be perfected before a new comparative watershed study is undertaken. With this objective in mind the Barranca installation is scheduled for a thorough analysis and revamping by Kraebel and Lowdermilk.

Range Research

"Scouting" was continued in the foothills of the eastern side of the San Joaquin Valley, as a foundation for the later establishment of intensive work.

The thirteen temporary foothill plots were examined twice during the month. These plots, scattered along the front of the Stanislaus, Sierra, and Sequoia forests, at different elevations and on different kinds of range, are yielding information on the growth and winter development of important range plants, and other important points. For example, the beginning of growth of numerous forage plants quickly followed the first winter rains, but during the cold weather of the past few weeks, development has been very slow. In fact, on certain areas, average density and height were slightly greater on January 5 than on January 25. Forms for recording data from these plots were further revised.

Fire Research

General

During the past month considerable attention has been given to the work plan for 1932. In general, the work contemplated will be in continuation and development of the 1931 program. A summary of accomplishments, and a statement of plans was made for the regional investigative committee. At the same time illustrative material, pre-

pared during the month on various phases of the fire research work, was exhibited. While this illustrative material was designed immediately for the meeting, its usefulness will be permanent.

The revision of the preliminary draft on visibility mapping and planning a detection system is being undertaken preparatory to publication. The work of evaluating points and planning a detection system for the remainder of the experimental area made satisfactory progress during this period.

The Slide Rule as a Tool in Visibility Sketching

One of the more important phases of present work on the Shasta experimental area has been the development of visibility sketching technique. The field sketching method offers the most practical method of obtaining visibility, in that with recently developed technique the method is at once accurate, rapid, reliable and conclusive. Other methods (the profile and relief model), require field checks besides considerable office detail. They are, however, simpler in that the technique is easily grasped and applied. The technique of field sketching has not previously received much consideration. As a result, old visibility maps on this basis have usually been extensively constructed and useful only in giving a general conception of areas covered.

One problem of visibility mapping consists in the determination of the lower vertical limits of seen areas. Consider a sketcher working with a contour map, plane table and alidade on an observation point. On any radius drawn, only some portions will be visible. Specifically, the problem consists in determining the elevation of the point on ridge B where the line of sight over A is intercepted by B, A being the ridge nearest the sketcher, B the visible ridge next removed. On a diagrammatic profile sketch showing the observation point O.P., and ridges A and B, a horizontal line from O.P. can be drawn and a vertical dropped to the interception on B. Then in the right triangle so formed we have the distance of A from O.P., and the elevations of A and O.P. (from contour map). This enables us to obtain the gradient (per cent slope) of the line of sight. Our problem is to determine the length of the vertical leg of the right triangle, in other words the difference in elevation between B and O.P.

This problem can be readily solved if the length of the other leg of the triangle is known. However, this length can only be roughly judged. All methods used in solving this problem are essentially ones of trial and error, involving the approximation of the horizontal distance from O.P. to B and then solving the triangle. If the difference of elevation obtained when plotted on the map gives a distance from the O.P. greater than the assumed distance, correction is made in the direction indicated and the difference of elevation redetermined on

the new base. One point and only one on any line will satisfy the angle of the line of sight.

The problem can be solved in the field with map, pencil, scale, and paper but this approach is too laborious to be practical. Our efforts to decrease computations have been successful. The first approach was by the construction of an alinement chart, followed by a per cent graph on cross section paper. The latest method has been by the use of an ordinary 10" Mannheim slide rule.

The equation to be solved may be expressed:

$$e = d \times 5280 \times g$$

in which e = diff. in elevation between O.P. and lower limit of visibility in feet.

d = Dist. to lower limit of visibility in miles

g = grade % line of sight.

To multiply by 5280 would require an additional setting of the slide rule. To obviate this we may divide by the reciprocal .0001894, and eliminate one step. This reciprocal is a constant in these calculations and should be permanently marked on the B scale as "M". Thus simplified the formula becomes:

$$e = \frac{d \times g}{.0001894}$$

To illustrate: We wish to know the difference in elevation between the O.P. and that of a point which we estimate to be 7 miles away. By an Abney reading, or through computation, we determine the grade over the intervening ridge at 3%. With these values the above formula becomes:

$$e = \frac{7 \times .03}{.0001894} = 1109 \text{ feet}$$

On the slide rule, set the index 1894 on the B scale opposite 3 on the A scale, and over 7 on B scale read 1110 feet on A scale. The determination of the decimal point constitutes no problem in the field, as we would know at once by observation that the elevation difference could not be 11 feet, 111 feet, or 11,100 feet, but must be 1110 feet. We locate the point of intersection of the line of sight with the map contour determined, and check the assumed distance of 7 miles. If the plotted point is more or less than seven miles away, then we simply shift the runner backward or forward as indicated until we obtain an elevation and a distance which check.

To eliminate the necessity of subtracting differences in elevation from the elevation of the O.P. for each observation, a simple device may be utilized. For any O.P. a difference in elevation of 100 feet will be read at 1 of the first cycle on the A scale, a difference of 200 feet at 2, and a difference of 2000 feet at 2 of the second cycle. We then mark with a soft pencil, above the difference in elevation on the A scale, the corresponding absolute elevation. Thus for an O.P. with an elevation of 6000 feet, 5900 will be marked above the 1 of the first cycle, 5800 above the 2, etc., and 4000 above the 2 of the second cycle. In this way we are enabled to read directly the absolute elevations of any desired location sighted.

When no instruments are used to determine the grade per cent, this may be determined by measuring the distance and difference in elevation of the intervening ridge from the O.P. as recorded on the map. The difference in elevation is set on the A scale and the distance in miles beneath it on the B scale. The grade per cent is then over the factor "M" (.0001894). No further setting of the slide rule is necessary to solve the main problem.

A similar problem occurs in looking over a ridge on to gently sloping or level country. In that case we can approximate the difference in elevation closely from the contour map and from this approximation compute the distance by setting the "M" factor on B scale under the slope per cent on A scale, reading the distance on B scale below the elevation on A scale.

Some method is needed to check the judgment of the sketcher in visibility mapping. Of all methods so far attempted, we find the slide rule method the most rapid and accurate for solving problems involving vertical elevation of the line of sight.

Forest Products

Logging and Milling Study

The so-called direct method of curving costs and values over D.B.H. for each species dealt with complete trees only. In so far as possible, the trees were treated as units without reference to the number, diameters and grades of logs cut from them. The difficulty and cost of following the trees individually from stump to green chain and synchronizing the logging with the milling study under California pine region operating conditions have been referred to in previous monthly reports. The other way of making an economic analysis of a lumbering region, by carrying on studies in the woods and in the mill independently of each other and then converting costs and values from a log diameter-grade basis to a tree D.B.H. basis by means of tables showing the composition of trees by D.B.H. classes in terms of proportionate volumes in the various log-diameter-grade classes,

has obvious advantages from a conduct-of-study standpoint. As far as operating costs by tree D.B.H. on a reconstructed basis are concerned, there has never been much room to question the accuracy of results, but, due to rather wide variations in value between different logs of the same species, size, and external appearance (grade), the accuracy of results from reconstructing values has been debatable.

Since last October, Brundage has been working on various methods of building up overrun, cost, and value curves over D.B.H., based on weighted log overrun, costs and values. A preliminary rough comparison between the tree curves and built-up curves for sugar pine showed a marked difference in costs for the smaller trees. As the analysis of the reasons for the difference progressed it appeared probable that the tree curves, and not the built-up curves, were out of line at the small D.B.H. extremity, from a practical, common-sense standpoint, even though they had been extended and balanced according to statistical Hoyle. From about 22" to 24" D.B.H. and upward the two methods compared quite closely, but from 24" downward the curves parted company in very decisive fashion. Insufficient and abnormal samples of small completed trees (i.e., trees followed in toto from stump to green chain) appear to explain the lack of harmony between the two. The built-up curves included enough extra trees measured in the woods but not delivered to the mill to represent correct averages of the small sizes as they would come in if cut on a big scale.

The work on building-up methods just completed, or nearly completed, proves beyond doubt that a system has been developed which not only will give results well within the range of accuracy required both in built-up tree costs and built-up tree values, but which is more reliable instead of less so, at least for California region logging and milling studies, than the physical tie system. This does not mean, of course, that a single tree, or a small group of trees of a given D.B.H. class can be appraised more accurately by measuring and grading in the woods after bucking, and then rebuilding from average logs brought in from the same general area, than they can be appraised by individual follow-through. It does mean that curves more truly representative of actual costs and values over a large area will result from the system referred to. In the analysis made here, the first method tried for building up tree values was not wholly satisfactory because the D.B.H. groups and the log diameter groups used took in too great a range. A more refined method, just completed in application a few hours before this item is written, has given a series of points on cross-section paper which deviate so little from lines of smooth and definite trend that the balanced curves practically coincide with all but two or three of the dots over the largest tree sizes. One reason for the strength of these curves is the large volume of 4 million feet of logs from which they are derived, which is almost twice as great as the volume forming the foundation of the direct method. The method of determining the proper point for plotting averages of 3" D.B.H. groups on the D.B.H. axis appears to have the greatest influence, however, in ironing out the deviations due to weak tree samples. This method is

somewhat too complicated for explanation in the space available here, but it makes possible the adjustment in the completed tree curves of unreasonable irregularities which had previously caused a lot of trouble in balancing.

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CENTRAL STATES FOREST EXPERIMENT STATION

General

During January the director attended a number of forestry and conservation meetings in Columbus. On January 13 he attended a luncheon meeting of the Ohio Water Conservation Board; on January 17 he gave a forestry talk to the young people of St. James Episcopal Church; on January 20-21 he attended the conservation convention sponsored by the Ohio Conservation Council, with meetings of the Ohio chapter of the Izaak Walton League and the League of Ohio Sportsmen.

These meetings have strengthened our conviction that the problems of timber production, waste land utilization, flood and erosion control, and wild life conservation are inseparably related. Progress in their solution depends largely on the ability of foresters, agriculturists, engineers, conservationists and sportsmen to get together to agree upon a constructive and comprehensive program of conservation and restoration. Until we can present such a united front, the individual organizations must continue to peck away at their particular problem in a more or less ineffectual manner.

On January 12 Dr. Hall gave a talk to the Forestry Club of Ohio State University on the importance of forest entomology in this region.

The Research Council committee on correlation of research is beginning to function. Reports on investigative projects have been received from Illinois, Indiana and Tennessee, although only a few organizations within these states have been heard from. The Station's projects are also ready for reporting.

The Secretary has suggested, in his letter of December 12, that all organizations within a state report their projects through the committee members of that state, so that he would have a first hand list of local projects. However, if any committee member needs or wants help in circularizing the various organizations interested in forest research in his territory, the Station gladly offers its assistance.

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INTERMOUNTAIN FOREST & RANGE EXPERIMENT STATION

FOREST MANAGEMENT

Methods of cutting Lodgepole Pine Wasatch National Forest

The Plots

This report covers two one-acre plots located on the north side of the Wasatch N.F. in sections 10 and 18, T. 2 N., R. 11 E., S.L.M. The plots for the most part are well located, plot one being situated on a gently sloping ridge and with uniform conditions throughout; plot two is on a characteristic bench with one low ridge breaking the drainage in the center of the plot, and a swampy draw is included which naturally is an undesirable feature. The elevation of these plots is approximately 9,000 and 9,700 feet respectively.

The same site characteristics prevail on both plots bringing them within Site II by the Region Four lodgepole site classification.

Treatment

Plot 1 has been subjected to two cuttings, the first a quality cut in 1880 when 26 trees or 104 ties were removed, and the second in 1915 when the stand was cut-over under Forest Service marking practice of a heavy selection cut and 50 trees containing 200 ties were removed. Plot 2 was cut over in 1914 and 85 trees or approximately 380 ties were removed under the Forest Service system. The slash on these areas was piled and burned.

The sample plots were established in 1926. All trees over 3" d.b.h. were tagged and the diameter measured. A chain square reproduction plot was laid out on each plot in what was considered to be average conditions and the reproduction one foot high to 3.6" d.b.h. was counted and tallied by species. These plots were remeasured for the first time in October 1931 thereby ascertaining the growth for a period of 5.5 years.

Results

Casual examination of the remeasurement data indicated that the rate of growth had been so low that the increase in volume could scarcely be determined by use of our present volume tables. Therefore, a quick summary by basal area has been made to indicate the trend at this stage. The results of this brief summary are tabulated as follows:

Lodgepole Pine

(New trees and trees under 3.6" d.b.h. not included)

Basal Area		Losses	Net total:	Total in-	Net	Growth*
		in	increase	crease in:	Growth	%
Original	1st Remeasure	basal	in basal	basal area:	%	excluding
1926	1931	area	area	excluding:		Losses
				losses		
200.322	204.095	6.113	3.773	9.886	.35	.89

Alpine Fir

23.908	28.231	-	4.323	4.323	3.29	3.29
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*Growth per cent is the mean annual increase in area expressed as a per cent of the original stand.

Although any far-reaching and exacting conclusions are to be strictly avoided from this meager information, these preliminary findings are indicative of future determinations. Obviously the above indicates the lodgepole reserve stand to be in a rather discouraging light. The net growth per cent of 0.35 means that the stand is barely holding its own with the few minor losses encountered which are by no means unnatural. When losses are disregarded and area increase figured on the basis of a sound, living stand the growth per cent of 0.89 indicates an inactive reserve stand although this may be typical of this slow growing species.

Attention is called to the inroads of alpine fir on the stand both as to volume and reproduction. Originally alpine fir made up 10.66 per cent of the total stand by area and at present it makes up 12.15 per cent, or an increase of 1.49 per cent, which means 53.4 per cent of the total net growth was put on by alpine fir or when losses in both species are disregarded, 30.4 per cent of the total growth was made by alpine fir. Other indications of inroads of alpine fir are that new trees reaching 3.6" d.b.h. of which 27 were tagged in 1932, 22 are alpine fir and only five are lodgepole pine. Reproduction counts, however, seem slightly to favor the increase of lodgepole pine as is shown by the following tabulation which is self-explanatory.

Reproduction from 1" to 3.6" d.b.h. :				Reproduction under 1' high, 1931			
: Number on		: Number		: Number on		: Number	
Species:	Reprod. Plot	Per Acre		Reprod. Plot		Per Acre	
	: 1926	: 1931	: 1926	: 1931			
L. P. :	14	: 50	: 140	: 500	: 30		: 300
A. F. :	94	: 118	: 940	: 1180	: 41		: 410
E. S. :	2	: 3	: 20	: 30	: 3		: 30

Summary

The conclusions merely strengthen present cutting practices in lodgepole pine; that is chopper's selection, in which every merchantable tree is utilized. Full utilization at the time of the original cut is the most desirable since it holds losses to a minimum. It opens the stand fully to allow lodgepole reproduction favorably to compete with the more tolerant alpine fir, it strengthens the economic condition by allowing a heavier cut per acre which is favorable to both owner and purchaser, and the rate of growth is such that the merchantable reserve stand will be decadent and seriously defective, if not dead, before sufficient time elapses before a second cut can be made. The growth per cent figures by diameter classes show clearly the early stagnation of lodgepole pine on these plots and further suggest that the fullest possible utilization be obtained in the original cut.

The question of obtaining sufficient seed to reproduce the stand under this method can only be empirically answered by the supposition that there will be ample seed furnished by the unmerchantable class of mature timber that would be left following any extensive method of cutting. - C. A. C.

Fire Conference

A fire conference for Region 4 was held to revise the fire protection policy of the region based upon the experience gained during the severe fire season of 1931. One of the points given outstanding emphasis was the need for research on various fire problems.

One of the problems is to develop a basis for predicting the "explosive" conditions encountered last summer; the worst ever experienced in the region. It seemed that in addition to high inflammability of dead material, growing timber, especially in the ponderosa pine type, became so inflammable that under certain conditions the foliage literally exploded when fires reached it. It will be especially advantageous if indicators can be developed which will forecast such conditions in the abnormal year so that the fire organization can be re-enforced in plenty of time to meet the hazard.

Another need which developed was for the analysis of past fire records as a guide for future procedure, etc. The data for the years 1921 to 1930 were coded by the Station a year ago. The 1931 data were extracted and coded in December.

RANGE MANAGEMENT

Land Tenure in Utah

A study of land ownership and utilization in Utah was made from census figures as of January 1, 1930.

There have been patented by various land acts and railroad grants 8,859,649 acres, of which about 2,500,000 are railroad lands. Out of a total of 7,464,276 acres of educational and public purpose land all but 2,800,000 have been sold to private individuals. The national forests in Utah have an area of just less than 7.5 million of acres, and Indian reservations just less than a half million. Altogether, there are more than 8 million acres of withdrawn lands other than forests and Indian lands, but more than 6.6 million acres of these reservations are repeated either in the other reservations or among themselves, leaving a net of 1,718,382 acres of withdrawn lands. Besides these lands, there is a residue of just over 25 million acres of unappropriated and unreserved public domain, and more than 1.3 million acres of unperfected entries.

Status of land control in Utah, 1930

Privately-owned Land Patented under Various Acts:

Owned by farmers and stockmen	5,613,101
Owned by railroads	2,500,000
Owned by corporations other than railroads	<u>746,548</u>

Total patented under various acts8,859,649

Educational Land Grants:

Still owned by state	2,800,000
Passed into private ownership	<u>4,664,276</u>

Total7,464,276

National Forests (net)7,475,762

National Parks and Monuments 117,100

Indian Reservations 452,627

Withdrawn Lands	8,328,072
Less repeated in other classes,	6,609,690
Net withdrawals	1,718,382
Unperfected entries	1,362,097
Public Domain (unreserved)	
Surveyed	13,192,133
Unsurveyed	11,955,734
Total	25,147,867
Total land surface of state	52,597,760
Water surface	1,795,840
Total area	54,393,600

The data in these tables when complete are to form the body of a chapter in a larger publication to be gotten out by the State Department of Education for Utah. Various public agencies in the State, including the Intermountain Forest and Range Experiment Station, are preparing chapters. G. S.

Summer Ranges

Increase in Carrying Capacity in Oakbrush Type by Artificial Reseeding

In 1929 species of Agropyron, Bromus and Melilotus were sown in heavy sagebrush and oak type at two areas in the oakbrush zone at the Great Basin Branch Station near Ephraim, Utah.

In July, 1931, a reconnaissance was made and the carrying capacity computed, for cattle, of representative plots, in these two areas, of crested wheatgrass (Agropyron cristatum), violet wheatgrass (Agropyron violaceum), common brome (Bromus inermis), many-flowered brome (Bromus polyanthus), and yellow sweet clover (Melilotus officinalis).

Following is a table showing the species sown, date of sowing, method of tillage, and per cent increase in carrying capacity by artificial reseeding.

Species	Date sown	Method of Tillage	% Increase in carrying capacity by Artif. reseed
Agropyron cristatum	June 1929	Broadcast on ground and trampled by sheep	23
" "	" "	Sown broadcast in contour plowed furrows and brushed in	43
" "	Oct. 1929	do.	29
" "	June 1929	do.	51
" violaceum	Oct. 1929	do.	42
Bromus inermis	June 1929	do.	48
" polyanthus	" "	do.	41
" "	Oct. 1929	do.	50
Yellow sweet clover	" "	do.	33

The carrying capacity was increased 33% by sowing yellow sweet clover, 42% by sowing violet wheatgrass, 45% by sowing many-flowered brome, 48% by sowing common brome, and from 23% to 51% by sowing crested wheatgrass varying with the method used. The best stands were produced on the best sites. During the period from 1929 to 1931, there have been two seasons of extreme drought on the summer range.

To test the ability of the newly established plants, of these species, to withstand grazing, cattle were permitted to graze the Maple Creek plots after the reconnaissance had been made. It is planned to make re-estimates of these plots to note any changes in carrying capacity.

- R. P.

Management Desert Shrub Range

Hutchings has gone to the "West Desert" to make observations on the feed conditions and of the range use following the severe drought of 1931. He will also make palatability studies and contact the sheepmen to learn all possible about their yearlong range operations.

Erosion-Streamflow

Colorado River Erosion Survey

Jay Higgins of the Region 2 office at Denver, and who made a survey of erosion conditions on the "West Slope" of the Colorado River watershed in Colorado, arrived in Ogden, January 4, to spend approximately a month working up a report on the season's work.

A preliminary report of the findings resulting from the extensive survey of erosion conditions on the Upper Basin of the Colorado River conducted during the past field season has been submitted to Washington. The survey shows rather widespread active erosion occurring generally at medium and lower elevations. Acceleration in the rate of erosion has occurred during the period of settlement of the region. Mr. Higgins and Mr. Deming are now engaged in preparing a more detailed account of the conditions observed.

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NORTHEASTERN FOREST EXPERIMENT STATION

Behre has analyzed data from the remeasurement after five years of the taper of red spruce trees released by partial cutting on the experimental area at Cherry Mountain, N.H. The actual changes in form during the five year period confirmed the indication obtained by increment borings from the same trees analyzed in 1925 and also agree with Meyer's conclusions based on increment borings in western yellow pine. Although there was no significant change in the average form quotient of the trees studied, it appears that all the trees tended to approach a common mean, those which had high form quotient at time of cutting decreasing, and those which were of low form quotient increasing. Although only fifteen trees were available for this study as a result of heavy windfall in the first two years following logging, use of Bean's short graphical method of multiple correlation permitted some analysis of the relationships involved. Change of form of the individual trees was clearly shown to be most strongly influenced by form quotient at the time of logging with diameter, height, and length of crown also showing a characteristic influence.

Spaulding and Hepting finished their preliminary report on investigations of the rots of balsam fir where decay has a direct relation to the age of the trees infected. Vigor of growth was found to have no pronounced relation to decay. Most of the cull is caused by two butt rots and a trunk rot, the causal organisms being Polyporus balsameus, Poria subacida, and Stereum sanguinolentum, respectively. The butt rots are especially serious because of their weakening effect resulting in windthrow. In the most severely infected stands studied, which were about 50 years in age, it was found that as much as 20 per cent of the total number of balsam fir trees were windthrown as a result of weakening in the butt caused by these butt rots. On average areas a loss of 7 per cent was found. Since many of the standing trees were also found to have butt rot much more loss is certain to occur and it appears that salvage operations ought to be made immediately.

MacAloney completed reports on the attack of Scotch pine by the white pine weevil, and experiments on the trapping of the weevil. Scotch pine of the Riga or northern variety appears to be remarkably resistant to weevil attack, the larvae apparently being unable to survive the vigorous flow of pitch. No success was had in efforts to trap white pine weevils with various baits.

Accompanied by Mr. Tillotson and Mr. D. C. A. Galarneau of the Massachusetts Conservation Department he assisted in directing the reclaiming of some 38 acres of severely weeviled white pine plantations belonging to the Crane Estate at Dalton, Mass. Such work is of particular interest at this time because it is being done both in the interest of stand improvement as well as to aid the unemployment in the town of Dalton. MacAloney plans to locate additional permanent sample plots in white pine plantations in this same township next spring.

The 1931 remeasurement figures of girdling plots established in 1929 near Waterville, N. H. were recently compiled by Westveld. These figures, preliminary in nature, give some idea of the rate of response to girdling operations. The plot on which selective girdling of hardwoods was practiced in 1929 contained at that time 425.3 cubic feet of spruce and fir per acre. Two years later the same plot had 510.6 cubic feet per acre, an increase of 85.3 cubic feet. The increase in growth during the same period on the check plot amounted to 54.6 cubic feet per acre; the original volume of 658.4 cubic feet per acre having increased to 702.6 cubic feet per acre. Thus the average annual increase was only 27.3 cubic feet per acre on the check plot compared to 42.6 cubic feet per acre on the girdled plot.

The planting investigation promises to develop, eventually, into a broad study of the methods and economics of reforestation. During the past summer and fall attention has been concentrated upon the measurement and examination of the oldest plantations which are found in the Northeast. The great difficulty which has been encountered in going over these early plantations is that very little of the early history of any plantation can now be obtained. In no instance has it been possible to obtain an exact record of the source of seed used. During December a study was made of the plantations upon Cape Cod. These constitute some of the oldest plantations in Massachusetts. Many interesting differences in the growth and form of the trees in the Cape Cod plantings could be interpreted if more were known as to the methods used when the trees were set out.

Plans are now being completed with the New York State Conservation Department to make a series of cooperative plantings of Scotch pine grown from seed collected from an excellent stand in that state. The station will arrange to have this stock planted on a variety of sites covering the more typical conditions encountered in the Northeast. It is believed that such studies will greatly aid in developing knowledge of the effect of soil and climate upon the same seed stock.

During January Stickel's final report of the Cranberry Lake fire-weather study was published by the New York State College of Forestry. In the analysis of the Petersham data Stickel, assisted by Miss Weldon, has completed a set of alinement charts for estimating duff moisture content and forest fire hazard in the white pine type. The alinement charts are for readings taken at 11 a.m., 2 p.m., and 5 p.m. In these charts duff moisture is estimated from measurements of air temperature, relative humidity, and hours since last precipitation. It will be noticed that the factors involved for Petersham are the same as those used for the Cranberry Lake data except that relative humidity has been substituted for evaporation. At both areas evaporation was found to be the best single index to duff moisture content. For the Petersham data, however, it was found that a combination of air temperature, hours since last precipitation, and evaporation gave very little increase in the accuracy of the estimate over evaporation alone. When relative humidity was substituted in place of evaporation in the equation, estimates having nearly the same degree of accuracy were obtained. Although this final selection of factors results in a slight loss in the degree of accuracy, it is felt that this loss is more than offset by the wider application of the data.

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NORTHERN ROCKY MTN. FOREST AND RANGE

The Regional Investigative Council meeting was held in Missoula. The men in attendance at all or part of the meeting and the agencies represented included the following in addition to the Experiment Station personnel: E. W. Kelley (Chairman), Elers Koch, F. J. Jefferson, G. A. Smith, T. Lommasson, D. S. Olson, R. F. Hammatt, P. Neff, W. N. Rush, B. Park, and M. H. Wolff, of the Forest Service; S. N. Wyckoff, C. C. Strong and C. H. Johnson, of the Office of Blister Rust Control; J. C. Evenden, of the Bureau of Entomology; C. D. Faunce, of the Indian Service, F. C. Crombie, of the Weather Bureau; T. C. Spaulding, J. H. Ramskill, C. W. Waters and C. H. Clapp, of the University of Montana; M. L. Wilson, of the Montana State College; E. E. Hubert, of the University of Idaho; Roscoe Haines, of the Lumber Department, Anaconda Copper Mining Company; C. L. Billings, of the Clearwater Unit, Potlatch Forests, Inc.; E. W. Hall, of the C. M. & St. P. Railroad; W. A. Denecke, of the Rambouillet Sheep Company; V. O. McWhorter, of the Triangle Sheep Company; and J. E. Norton, of the Judith Basin Experiment Station.

The highlights of the meeting were: (1) the presentation of substantial and important progress during the past year by the various agencies engaged in research; (2) a lively discussion of the noteworthy expansion planned for the coming year, particularly in the field of

range research; (3) a stirring talk by C. L. Billings, general manager of the Clearwater Timber Company, who had been asked to comment frankly on the character of the annual investigative meeting and on the value to the lumber industry of the research work of the various agencies and how that value could be increased.

Billings felt, in general, that too much emphasis was given in the annual meeting to post mortems on work accomplished instead of on an analysis of what is ahead and what should be done about it. Billings also felt that there was some lack of coordination between research agencies in the Region, with consequent duplication; that research workers were too slow and guarded in giving their results to the interested public, and that steps should be taken to publish findings in such a manner as to make them easily understandable, particularly in their application to getting better management on forest lands; and, third, that we strongly need a liaison officer of some sort to work between the research organization and the lumberman. These suggestions were all considered in detail at a special meeting of the executive group of the Council. The decision was reached that the general open meetings were very much worth while and should be continued. But an additional day's session will be held to be attended only by executives, this meeting to be chiefly a program planning meeting at which the program as organized, methods, emphasis, and results would be critically discussed and any desirable changes inaugurated. Ways and means of getting out research results in quick time were also discussed, and the Experiment Station was selected as the collecting and issuing agency for the various research groups in the Region, the form of presentation to be along the lines of "Applied Forestry Notes", previously issued at this station. It was agreed that Mr. Billings' suggestion on a liaison officer was one of much merit, but no definite action seemed possible at this time.

Range Studies

The portion of the annual meeting devoted to range research was a particularly live one, due to the interesting economic features of the problems discussed and the participation in the discussion of a large number of newcomers whose outside viewpoints were a fine contribution to the discussion of the problems ahead in range and land use in the plains and Inland Empire portions of the Region.

Hurtt briefly reviewed the land utilization problem in eastern Montana and eastern Washington. The discussion of the outside people keyed into this presentation. All agreed that unwise land use has been a major factor in the present disturbed economic and social situation in the Northwest and that range research should take a pronounced place in securing the needed facts to get on a sounder basis.

The range section of the program was full of interest and helped very materially in getting our newly-started range research oriented. A Regional land use conference is to be held some time this summer.

Interest in streamflow and precipitation relationships has appeared from various quarters during the past month. Former Congressman Stout has intimated that sheep-grazing in the Snow Mountains of the Jefferson has been responsible for very low water stage in the streams near Lewistown. Hurtt found that the streamflow on both the Judith and the Musselshell Rivers was lowest of record during the first 9 months of 1931 and less than one-tenth the volume for 1927, which was the last year of precipitation up to normal for eastern Montana. The Montana Power Company is seeking information on the relationship of precipitation and run-off, and Chancellor Brannon and State Engineer James and others have expressed keen interest.

Hurtt spent some time during the month in starting a station herbarium. A suitable case and a number of plants from the Regional and from his personal collection now form the nucleus for the station herbarium of more than 50 species. Bids for fencing material needed at Miles City experimental pastures have been invited.

Analysis of the Fire Records

The punch card system of summarizing information from the fire reports was given a test which was passed with flying colors. A request was made on short notice, for some very detailed information of value in the conduct of the spring allotment conferences. It was desired to know for each timber type on each forest just what kinds of man-caused fires deserve the most attention, and whether that attention should be directed chiefly outside the boundaries or inside, and at what elevation class.

A description of the necessary sorts and tabulations was prepared late in December. On January 12, the 42 finished tables were supplied to the conferees, covering all the man-caused fires and showing number, cost of suppression and area burned by forests, timber types, causes, years and altitude classes, and all these separately for fires starting inside the boundaries and those starting outside. Extra copies of these tables were provided so that each forest can study its own data and lay out a specific program of the action needed to do more to prevent its greatest troubles in the overburned types. Likewise, Public Relations is using the same information to plan its campaign. Public Relations, however, apparently will want even more detail to show whether the smoker fires, for example, were from local people or outsiders, from travelers, ranchers, miners, stockmen, or who-hot. The punch cards give this information with a minimum of cost and time.

Coding of the 1600 fire reports for 1931 was started by Blake, Higgins, and Winston, supplied by the Regional Office, and Richards from the Experiment Station. Blake and Richards had previously qualified as experts by their assignments to the big job for 12,000 fires a year ago. If the Washington Office is able to punch the 1600 cards and run them through the machines in late February and March, the transcription of summarized data to sheets B to K should be completed on schedule and at a great saving of labor to the Forests.

Two new ideas are being injected into the coding of the fire reports for 1931. The first is an attempt to determine the number, cost, and area burned by fires on those units of area chiefly valuable for timber production, for grazing, for water control, and for scenery and recreation. The Office of Lands has been asked to prepare a map delineating each of these purpose units, which will be given a number to be coded on the cards for each fire. This is in anticipation of the future designation of different degrees of protection warranted according to land use in addition to timber type. At present we do not know the fire load, the cost, or the loss by units of area - often embracing several adjoining forests - according to the principal value and use of such areas.

The second new idea has been found by Hornby to be more and more important, as he continued his analysis of the fire records aimed at determining how many men to send to fires of different sizes on any combination of timber and fuel type, slope, wind, and dryness of the fuels. At present our records of fires of a certain size in a certain type and slope show a great range in the number of men required for control. Obviously this is to be expected, as these records mix cases of no wind and moist fuels - when one man is enough - with cases of considerable wind and extremely dry fuels - when several men are necessary to control even a small fire. Consequently an attempt is being made with the 1931 fire reports to show for the day of origin of each fire, how many days had elapsed since a good rain at that spot and what the minimum humidity, wind, duff and wood moisture were on that day of origin. Jerison is assisting in this work, which should permit grouping of fires so that we can determine more accurately for each timber and fuel type, for any particular slope, any number of days since last rain, any prevailing wind, humidity and fuel moisture, the most efficient number of men to send if the fire will be one-hundredth, one-tenth, or one-quarter of an acre, or any specific size when they arrive.

As this statement indicates, there are several factors to be considered in estimating the number of men to send to a fire, and no analysis of records or determination of general rules will ever be able to displace good judgment based on long experience. But practically all forest officers recognize the fact that all of us have not had this "long experience". Perhaps we have just taken over a new ranger district or forest with timber types and conditions new to us. Or

perhaps we have some men whose judgment does not agree with ours. At present we have no general rules, standards or guides to turn to as an additional check and as a balance wheel to produce more uniformity of action. The rather general recognition of this need is clear proof that there are certain fundamental principles and factors that should determine the proper number of men to send to any specific fire. We believe that we can determine these principles so that they can be used in actual practice.

Measuring Forest Fire Danger

At the January meeting of the research Council, Gisborne distributed samples of his new Fire Danger Meter, which is a device intended to produce more uniform action in building up or cutting down the forest protective force according to prevailing and probable danger. The principle of protection in building up the force is the same as in sending more men to a fire; but it is also more fundamental, in that if the need for men has not been foreseen, and the men distributed, then there may not be enough available so that the proper number can be sent to a specific fire. On the other hand, if the need has been over-estimated, costs mount alarmingly and without justification.

The new fire danger meter is an adaptation of the slide rule idea used in the Harvey Exposure Meter. Six factors - season of the year, activity of fire-starting agencies, wind, humidity, fuel moisture, and visibility distance - are integrated by the two slides to indicate the degree of fire danger resulting. Seven degrees of fire danger are recognized, and the administrative significance of each is defined in terms of force of men needed. Just as no rule or standard can ever displace good judgment in determining the proper number of men to send to a fire, so this Danger Meter is not intended to displace the Supervisor's best judgment, or to relieve him of his responsibility in expanding and contracting his protective force. But the use of this meter, bringing six factors into the scheme with weighted emphasis, may help to produce more consistency of action by any man and more uniformity by the several men who should consider all of these factors in deciding upon the action to be taken.

During January, Jenison completed an article describing in detail the weather prevailing during the day that the Freeman Lake fire originated and spread at an average rate of 1600 acres per hour for 12 hours. The weather and fuel measurements were made at the Priest River Station only three or four miles north of this fire.

The tables, graphs, and text of a report summarizing 20 years of weather records at Priest River also have been completed by Jenison, ready for publication. As only 500 to 600 copies of this compilation should be a sufficient supply for 10 years, it will probably be mimeographed.

Silvicultural Studies

Compilation of five-year records of reproduction quadrats reveals some important facts regarding mortality and survival of seedlings in the western white pine type. Average results for 400 quadrats located on five large representative plots are given in the accompanying table. Three of the plots were established in areas burned by forest fire in 1926, and two in areas logged in 1926. The table shows, for the principal species in the type, the percentage of seedlings germinated in 1927 which died in the succeeding five years.

Percentage of Dead Seedlings

<u>Year</u>	<u>Character of Season</u>	<u>White</u>		<u>Doug.</u>	<u>White</u>	<u>Cedar</u>	<u>Hemlock</u>	<u>Average</u>
		<u>Pine</u>	<u>Larch</u>	<u>Fir</u>	<u>Fir</u>			
1927	Moist	33	25	19	12	30	41	27
1928	Dry	7	10	3	6	10	18	9
1929	Extr'ly Dry	10	12	9	14	32	19	16
1930	Very Dry	2	2	4	2	6	2	3
1931	Extr'ly Dry	0	1	0	1	3	0	1
Dead		52	50	35	35	81	80	56
Survived		48	50	65	65	19	20	44

The important findings are: (1) that a heavy toll is taken of seedlings through drought, high ground surface temperatures, and other causes, amounting to 52 per cent for white pine and ranging from 35 to 81 per cent for the other species; and (2) that over nine-tenths of the mortality occurs in the first three years of the life of the seedlings. The outstanding fact is that seedlings three years old and older can ordinarily be regarded as established and that of seedlings under that age only a certain percentage, frequently less than half, can be expected to survive.

The dependability of the three-year period defining establishment has a particularly strong basis in the present data, in view of the small mortality in the fourth and fifth years despite exceedingly dry seasons in these years.

Priest River Branch

Thompson reports real winter weather at Priest River, the total precipitation for January being 4.42 inches, with 36.6 inches in the form of snow. The total snowfall for November, December, and January has just passed 103 inches, with a total precipitation for this period of 15.61 inches. The snow on the ground is now about 36 inches deep,

and as there is no frost in the ground, conditions for moisture penetration are excellent.

Forest Survey

During the month G. M. DeJarnette joined the staff of the Experiment Station by transfer from the Regional Office. DeJarnette, who has been a member of the Regional organization since 1921, is well equipped for the Survey work which he will undertake by a varied experience in forest management work including the direction of timber cruising projects.

Bradner and DeJarnette visited north Idaho and eastern Washington to determine the extent, character and availability of the private, State and County cruise records. Officials of practically all of the large timber companies in north Idaho and northeastern Washington were interviewed and the companies' cruise records and maps examined. Timber operators are interested in the Survey, and in practically every case indicated their willingness to cooperate to the extent of making all their records available for use in the Survey. In addition to having the cruise records in their own timber holdings, most companies have made cruises of the merchantable timber, private or State, which is intermingled with their own blocked-out holdings. Practically all of the operators have kept cutting records and all of them have map records of the burned-over and cut-over lands within their holdings. A few of the larger companies have prepared type maps covering their own and intermingled holdings. In most cases the estimates include all the species within the stand, but it is admitted that the white pine estimates are the most accurate.

Only three out of the ten north Idaho Counties have made regular cruises of the merchantable timber in private ownership within their boundaries. Pend Oreille County, Washington, has rather complete cruise records.

Logging and Milling

A preliminary examination of the data of the larch-Douglas fir study does not indicate the usual marked increase in spread between production cost and selling value of individual trees as the tree d.b.h. increases. This is, no doubt, principally due to the character of utilization. On the average sawlog operation, 72% of the average tree (22" d.b.h. for western Montana) is removed from the woods in the form of sawlogs or left as culls unfit for conversion to lumber. This is based on the cubic volume of the tree from the stump cut (long butts excluded) to a point in the tree top four inches in diameter inside the bark. On the study area, where trees are converted to ties with no side lumber salvaged, only 55% of the average tree is converted into ties. This conversion percentage is the greatest for the twelve-inch

d.b.h. class and decreases on a sliding scale with a d.b.h. increase.

Lumber and Timber Products Census, 1931

Preparatory work involved in starting the Idaho-Montana canvass of manufacturers was handled by Whitney during the last half of the month. Supplies furnished by the Bureau of the Census were received.

Since the report on hewn, round or split timber products called for in the principal Bureau of the Census questionnaire will not provide production figures which are needed for regional purposes, a mimeographed supplemental schedule calling for quantities and values of poles, piling, posts, mine timbers, pulpwood and cordwood is being sent to operators in north Idaho and Montana with the large Form 311

- W. S.

Special

Nine forest officers are now enrolled in the course in Forest Products being conducted by the Regional Office of Operation. Anderson spent some time during the past month on the revision of the Logging and Milling lesson of the course, also in assisting the study course office in answering questions asked by students concerning Products work in the Region.

Lumber Prices and Movement

	1st Q., 1931	2nd Q., 1931	3rd Q., 1931	4th Q., 1931
Idaho White Pine	\$31.41	\$31.12	\$27.76	\$24.29
Western Yellow Pine	19.25	19.52	18.02	15.47
Larch-Fir	14.26	13.53	13.69	12.03
White Fir	13.76	13.82	11.04	9.94
Spruce	18.39	18.94	16.42	11.77

Shipment and Cut

	December, 1930	December, 1931
Shipment	53,977	39,223
Cut	40,624	12,927

PACIFIC NORTHWEST FOREST EXPERIMENT STATION

Howard Spelman - A great loss has come to the Forest Service and to forest research through the death, January 26, of Howard R. Spelman. In the few years that he was in the Service, his achievement was notable, first as an officer in charge of a large and difficult timber sale, and latterly in the Section of Forest Products.

He had promise of a brilliant future, but ill health forced him to retire a year and a half ago. His keen mind, his enthusiasm, his fairness, and withal his spontaneous friendliness made him a most delightful companion. His was a personality that was a most wholesome inspiration to his many friends.

Silviculture

Reproduction Studies in the Douglas Fir Region indicate that 1931 was the best season for survival since plots were established in 1928. The seedling losses totaled 66 per cent as compared with 95, 92, and 73 per cent in 1930, 1929, and 1928, respectively. An outstanding feature brought out by the work was that during the four years the study was under way, major losses occurred from four different causes, any one of which might practically wipe out a season's seedling crop; the causes were heat injury, frost, drouth, and consumption by mice. Losses in the open averaged 94 per cent as compared with 40 per cent under heavy shade.

Isaac re-established the broadcast seeding plots in the fog belt that have now been repeated for the fourth season. Seeds of the small seeded species, Sitka spruce, western red cedar, western hemlock, and red alder that are common in the spruce-hemlock type were used and Douglas fir was included as a check. Results of the previous years' seeding have been quite satisfactory.

Phenology - Kolbe spent a few days listing the phenology field records made at 21 stations in the Douglas fir region on the office record cards. Over 1200 observations were made this year. This is the fifth season that the project has been carried on, and therefore we plan in this year's progress report to prepare a phenological calendar for each station. This will show the sequence of the life events of the several plants on the schedule during the period as well as the average date on which they occurred. At present there are 36 species under observation.

Fire Studies

Reporting and Charting Lightning Storms - Lightning storm frequency maps based on the number of storms per hundred thousand acres during the last seven years have been made by Morris for Washington, western Oregon, and the Blue Mountains of eastern Oregon. All of the lightning fires which were recorded in the national forest fire atlases from 1925 to 1931 inclusive have been plotted, and frequency maps based on the number of fires per twenty-five thousand acres have been made. The difference in the size of the storm and fire units of area was necessitated by the tendency of fires to be concentrated in small disconnected localities rather than to occur in zones of gradually increasing frequency as do the storms.

Mensuration

Meyer spent January in Washington making use of the facilities there to work up a set of cubic foot and board foot volumes for Douglas fir. About 7,000 sample trees taken throughout the range of the species were used. The tabulating machines are also being used on routine work in connection with the growth of trees in selectively cut stands of western yellow pine, a part of the major study on the growth and yields of that species.

Section of Forest Products

Lodewick attended the annual meeting of the West Coast Lumbermen's Association in Tacoma on January 29. The discussions were confined to merchandizing, especially from the retailer's standpoint. Among other things, a large proportion of the outside speakers emphasized (1) the need of a research laboratory supported by the manufacturers, (2) the need of greater fabrication by the mills, and (3) more kiln drying and grade marking. The following morning was spent in visits to the Washington Parlor Furniture Company, Western Woodworking Company, and Wheeler-Osgood.

Lodewick reworked some of the Shevlin-Hixon mill scale study data to determine the possibility of correlating the yield in lumber grades with Dunning tree classes. The results obtained when each Dunning class was used separately were unsatisfactory. Results warranting further investigation were obtained when Classes 1 and 2 and Classes 3 and 4 were used as units representing immature and mature groups.

One morning was spent at the U. S. Engineer's office advising as to whether piling rejected by one of their inspectors did or did not meet the specifications.

Several inquiries point to a renewed interest in cedar and hemlock leaf oils, and in Oregon grape root. A determination of the outlets for these items would seem justified.

A card index of the secondary wood-using industries of the region has been made during the last few months. The list has been brought as nearly up to date as possible, having been checked against (1) letters and questionnaires in the office files, (2) Abbey's Index and supplements for 1931, (3) The Timberman Directory of the Lumber Industry (1931), (4) Chamber of Commerce lists of industries for several cities, (5) telephone directories of the larger cities, and (6) notes in recent issues of various trade magazines. Cards 5x7" are used in this index and provide enough space on the face to list the company name, address, officers, products made, and items of interest, such as plant additions, changes in personnel, and losses by fire. On the reverse side all data regarding lumber used, value of products, number of employees, etc., have been added from questionnaires found in the files. In short, each card will eventually provide a history of the company as complete, in the details interesting and valuable to this office as possible.

Logs, Lumber and Other Timber Products Census - During the month 1192 schedules were sent to Washington and 979 to Oregon companies. To date 390 replies have been received--Washington 250, and Oregon 140.

Rapraeger has given his time to computing and preparing reports on his two projects, namely, "Breakage Losses in Felling and Bucking" and "The Effect of Log Size on Western Yellow Pine Timber Volume and Production Costs".

Forest Insurance

A meeting was held for general discussion of Shepard's report "The Influence of Local Climate on Forest Fire Hazard in the Douglas Fir Region". Eighteen people were present, including the State Foresters of Oregon and Washington, a good representation of the private protective organizations of both states, Brundage and MacDaniels of the Regional Office, a rating engineer from the Oregon Insurance Rating Bureau, and the field representative of the "Logging Pool".

Current progress activities have consisted of effort at pushing the protection grading phase along toward completion through conferences with MacDaniels and the preliminary work of devising plans for the forest valuation phase.

Forest Survey

Almost all the survey staff, both those working on national forests and in the Portland office, have been busy at the compilation of inventory data gathered in the field. Wakeman has been check cruising at the lower elevations in the central part of Oregon. Kemp has been at field work in Lane County. Pratt has been in the hospital all month as a result of an automobile accident.

Mr. Geo. C. Joy, State Supervisor of Forestry in Washington, borrowed the survey's generalized type maps for four counties in Washington and found them of material assistance to the Forest Board during a meeting at which some 209,000 acres of land in western Washington were recommended for classification under the Reforestation Act.

Working plans for the compilation of inventory data for lands other than national forests have been revised, and with the exception of a few items connected with board foot, cubic foot conversion factors, are in final form so that they can be used next winter, when it is hoped a large force will be busy at this job.

The survey staff is somewhat of the opinion that to show inventory data by the groups of ownership decided upon may result in more work in compilation than the usefulness of the results will justify, especially when it must be remembered that ownership is constantly changing and is only gotten with 100 per cent accuracy at rather high costs.

On the national forests the old problem of gross areas and net areas was ever present. On one national forest the completed type maps and statistics had been turned in at the end of December. The man who had been at field work on this forest had been working under the assumption that the national forest areas as published in the official annual statistical report were sacred and could not be changed, an assumption which the members of the survey staff had also made. Therefore, he had forced his areas to fit the official values. When the survey staff checked his type maps with his area statistics, they soon felt that something was wrong. After working with his figures for a while, they wondered if the official areas might not possibly be in error; so a check on the official figures was started. Since the men working national forests have done all their field work on the latest base maps of the forest, it was decided to use the latest base map in the check. On this map all the quadrilaterals of earth's surface of 10' extent in latitude and longitude were marked off with red lines, and the square mile area of each such quadrilateral was obtained from Gannett's "Geographic Tables and Formulas". For those fractional quadrilaterals along the boundary of the forest, the portions both inside and outside the boundary line were planimetered, and also the total quadrilateral was planimetered to get a check on the two fractional parts. The two fractional parts were then reduced to per cents and the per cent of the quadrilateral inside the forest

was applied to the square mile area of the quadrilateral as shown in the table. The total square mile area of the forest was obtained by adding the areas of all the quadrilaterals together and multiplying by 640 to reduce the value to acres. This gave a result which was only dependent on the quality of the map, since shrinkage of paper had been entirely eliminated and errors due to planimetering had been reduced to practically nothing.

This process had furnished a very good figure for the relation between map values and planimeter readings; therefore, it was decided to planimeter every township (both whole and fractional, surveyed and unsurveyed) on the forest as a check on the first method. Then, to get a final check on these two methods, the General Land Office area of every surveyed township and the planimetered area of every unsurveyed township were added together.

The results were as follows:

Official area of forest	1,094,485 acres (7/1/31)
By adding status book township totals	1,097,700 " (1/1/32)
Computed 10' quadrilaterals for entire map	1,069,254 " (1930 map)
Planimetering all townships on map	1,070,693 " (1930 map)
Using G.L.O. values for surveyed townships and planimetered values for unsurveyed townships	1,073,991 " (1930 map)

It was assumed that the method of totaling the General Land Office areas for the surveyed townships and the planimetered areas for the unsurveyed townships, which gave the figure 1,073,991 acres, would be most acceptable to all concerned. This figure is 20,474 acres less than the official area of the forest. It was then argued that possibly the bulk of these 20,000 acres might have come from surrounding forests which might show this much less area on the status books than on the maps. Therefore, the area of each boundary line township was planimetered to get the area of that part of the township inside the forest and the area of that part of the township in the adjacent forest. When the areas of the boundary line townships in the adjacent forest were totaled and compared with the total of the status book areas for these same townships, it was found that the status book values were again greater than the map values, and to the tune of 8,184 acres, which made matters all the worse.

As matters now stand, the survey is hesitant about accepting any official figures without having them thoroughly rechecked, which is quite a job. At present, the plan is to check the map area of each national forest by the 10' quadrilateral method, which only takes two or three man-days per forest, and whenever the map value is less than 5,000 acres different from the official area to accept the official area and force the type areas on the forest to fit this official area. Whenever the difference between the map area and the official area is over 5,000 acres, a check-up of the official area should be made.

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SOUTHERN FOREST EXPERIMENT STATION

Forest Survey

Pine. The preliminary survey in Pearl River County, Miss., was completed as far as possible by January 14th. Due to high water resulting from the incessant rains in southern Mississippi it was impossible to get into all the bottoms. Pearl River and Hobelochitto Creek had flooded their bottomlands and at points along Pearl River west of Picayune the water reached four feet over the D.B.H. point on the timber. The flatwoods were ankle deep in water with water in the slash pine ponds almost knee deep. Under these trying conditions work was difficult and progress rather slow.

With all of the field men in the office, the compilation of the data was greatly speeded up. All of the data were transferred to compilation sheets ready for punch carding and the records as well as the original data were sent to Washington for analysis. Davis was detailed to the Washington office to assist in the analysis work.

From the line tally records it was shown that 89.7 per cent of the area of Pearl River County was classed as forest area. Approximately 7.5 per cent was in cultivation. The forest area was divided as follows:

<u>Forest Condition</u>	<u>Per cent of Forest Area</u>
Virgin	7.01
Culled	4.45
Cut-over	52.15
Denuded	32.04
Second growth	4.35

Over 45 per cent of the forest area has less than 10 per cent stocking of pine.

Hardwood. The Hardwood Survey Field Manual was completed and mit-

cographed so that the field crews starting the survey in DeSoto County, Miss., were supplied with copies.

A preliminary trip into northern Mississippi proved that it would be possible to run the northernmost strips in spite of the heavy rains, but the unprotected or "batture" lands are under three to six feet and more of water. The water is at the foot of the levees and in some cases is up two or three feet on the levee itself. In the Yazoo basin much of the timberland is flooded and conditions are getting worse.

Field work in the hardwoods was resumed when six men organized as one party began work on Line 1. This work was in the nature of a training job to acquaint the party leaders with the revised procedure.

A heavy rain caused small streams and drainage ditches to overflow their banks. One ditch rose over four feet over night and inside of 24 hours had again subsided. Water covered the former cypress brakes where cotton was grown in 1931 and the crew barely escaped swimming to get to and from their line. If such conditions continue to exist, it may mean carrying the work into the bluffs and uplands.

Hardwood Growth and Yield

Field work was severely handicapped on account of high water. As a result, plot locations have been confined to the zone immediately adjacent to main arterial highways. Practically all local roads, if not under water, are impassable, except after several days of clear, dry weather.

Bull, in collaboration with Putnam, is preparing a handbook for hardwoods. This manuscript covers the dendrological, principal distinguishing characteristics, distribution, and utilization of the bottomland hardwood species. The dendrological notes and the distinguishing characteristics will be particularly helpful to foresters working in the bottomland hardwood region.

New Public Domain

After a very brief reconnaissance survey of conditions in several of the southern states, Craig concludes that tax delinquency is an acute land problem in Florida. The best available information indicates that over 10 million acres, or 30 per cent of the total land area of the state, have reverted to the public domain.

The rate at which tax delinquency in the state of Florida is increasing is indicated by the following approximate figures which are the best available to date:

1928 -	1,800,000	acres	sold	to	state
1929 -	3,447,000	"	"	"	"
1930 -	<u>6,945,000</u>	"	"	"	"

Total -12,192,000, or 36 per cent of land area assessed.

Approximately 2 million acres of the above total have been redeemed over this period, leaving a net area delinquent on July 1, 1931, of approximately 10 million acres.

Naval Stores

The trees in last year's advance streak group have been regrouped and are now ready for the raising tins experiment. The trees in the chipping frequency test were dipped on the first of February.

A severe drought of the past five months has continued through January until there is at present a deficiency of about 13 inches of rain since August. Insect damage reports continue to come in and an article dealing with the interrelation of drought, turpentine, and fire was prepared.

Management

Wahlenberg supervised the burning of experimental plots to determine the influence of periodic burning on longleaf pine reproduction.

Germer removed chips from trees on the plots established by the Forest Products Laboratory in 1927. These chips were sent to the Laboratory for analysis which will attempt to correlate the formation of spring and summer wood with fertilizers, moisture, etc. Each chip included at least the last six years' growth.

Economics

A. E. Wackerman, formerly Forester for the Crossett Lumber Company, Crossett, Arkansas, reported for work on the Financial Aspects of Private Forestry.

The men working on the Financial Aspects of Private Forestry project are working on the report for Hempstead County, Arkansas, and for Polk County, Texas.

Erosion

Orders have been placed with the Louisiana State Nursery for nursery stock to be used on the planting projects on erosion control areas.

During the recent heavy rains, a number of catchment tanks on erosion plots already established have been in operation and have furnished excellent data.

Ecology

Possin prepared a memorandum on the moisture content of the soil on burned and unburned lands on the grazing experiment area at McNeill, Miss. To date the findings are inconclusive, showing in some instances slightly greater moisture content on burned areas and in other instances a somewhat greater moisture content on unburned lands.

Olustee

It has been with difficulty that fire has been prevented from burning on to the Olustee Experimental Tract. Crows have been called out several times.

A test designed to show the influence of rodent and bird activity on the number of seed germinating indicates that in some instances the entire seed crop can be eaten by rodents and birds. Seeds were found germinating under rodent and bird-proof cages established on seed-producing areas. Elsewhere rodents and birds seemed to have eaten all the seed that fell. The one exception to this general rule is a plowed plot where some seed are germinating.

Pathology

Forest Products. A check-up of a number of complaints of the occurrence of stain in Lignasol-dipped pine and hardwood lumber showed that a tendency exists among certain operators to become lax as to the proper handling and piling of dipped lumber. To check this tendency, a series of circular letters pointing out the limitations of such treatments and recommending means of improvement has been prepared in cooperation with Mr. Simmons of the American Pitch Pine Export Company. These letters are now being sent out to all mills using dipping treatments.

Further information and data in connection with the effectiveness of the borax dip and the deterioration of hardwood lumber stocks due to abnormally long storage periods have been gathered. The final

examination of one series of treated logs showed the ethyl mercury chloride, sodium tetrachlorophenolate and Cooper's end-coating treatments very satisfactory and superior to six others tried. No insect damage had occurred in the treated or control logs, in spite of the unusually warm weather during November, December, and January.

A conference with Chemist Meyers of the International Creosoting & Construction Company, Galveston, Texas, indicated that wood preservers are much interested in the new treatments as a means of preventing decay of poles and piling during seasoning. This company is starting preliminary tests at its Beaumont plant.

Hardwoods Disease. The work done upon fire and decay damage in the southern hardwoods was put into report form. These preliminary investigations showed that most of the heartrot of mature hardwoods, perhaps as much as 90 per cent, had entered the trees through wounds caused by fire. Once infection had taken place the decay was found to extend vertically at a rapid rate, the spread being as much as one foot per year in some trees. Fire and decay damage were found equally severe in immature trees; these two agencies combine to kill a number of trees and injure others so severely as to make them unmerchantable. These studies seem to emphasize the fact that fires are very destructive in the Mississippi Bottomlands and that were fires kept out decay losses would no doubt be much reduced.

Pine Disease. In January the manuscript entitled "The Brown-Spot Needle Blight of Longleaf Pine Seedlings and the Effect of Winter Burning as a Control Measure" received final revision and was sent to the Journal of Forestry.

Data gathered during the extensive survey to determine the prevalence of the brown-spot needle blight and its relation to the time elapsing since burning were summarized in an office report. With land that has been under fire protection a number of years, a single controlled fire will greatly reduce severe needle infection for at least one season and often, to a less extent, for two. On the other hand, where the disease is endemic, winter foliage persists through the following summer and fire destroys much needle foliage that would normally function through the next growing season. Retention of second season foliage by midsummer is an indication that the disease is not seriously injuring such seedlings.

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RESEARCH ACTIVITIES IN REGION 2

Roeser's time was largely taken up in preparing the annual investigative report. The last week was spent in the Denver office, at which time the various sections of the annual investigative report were reviewed and a program for the annual Committee meeting outlined. It was planned to convene the Investigative Committee on February 17.

E. R. Lepley and Clarence C. Averill, Junior Foresters, temporarily assigned to the Experiment Station by the Regional office during the winter months, reported for duty immediately after the first of the year. Their first task consisted in computing, recording, and transcribing the soil moisture data procured at the Fremont Station during 1930 and 1931. Considerable interest attaches to the late season record of 1931 because of the prolonged drought, which established this season as an exceptional one.

At the end of the growing season the percentage of soil moisture at the fourteen sampling stations had dropped below 3.50% at a depth of 10 inches, and below 3.54% at a depth of 18 inches. These figures are well below the moisture equivalent at 100 gravity for the particular soils used in sampling, and not very much in excess of the wilting coefficient of coniferous seedlings in the same soils.

The results of the 1931 measurements of the stands on the two blocks of lodgepole pine thinning plots at Pitkin on the Gunnison Forest were compiled. Those for Block A, in a 26-year old sapling stand, in which two plots were thinned in 1912, are of especial interest, since they emphasize the ineffectiveness of light thinnings in lodgepole pine stands when these cannot be repeated at frequent intervals. The stand records prior to 1926 are in poor shape.

The unthinned stand contained 10,174 trees per acre in 1926. The average diameter increase was .178 inches in five years. The net per acre annum increment was 41.6 cubic feet or 3.7%.

In the moderately thinned stand of 4,835 trees per acre in 1926 (3' x 3' spacing), the diameter accretion of .188 inches has been only a little more than that recorded for the unthinned stand. The net increment was 52.7 cubic feet per acre annum or 4.9%.

1,742 trees were left in 1926 in the heavily thinned plot, whose spacing is approximately 5' x 5'. Here the diameter increase of .323 inches in five years has been 82% greater than that of the unthinned stand. The increment rate for the five-year period was 6.1%, or 52.5 cubic feet per acre annum.

It will be seen that the increment per cent for the period of observation varied directly with the degree of thinning. Under heavy thinning as referred to here, a 100% return on the capital can be procured in about sixteen years at the present increment rate. In the lightly-thinned stand, twenty years would be required as compared with twenty-seven years for the unthinned stand.

What is more important, however, is the fact that the much faster rate of diameter accretion of the heavily-thinned stand, as compared with that of the lightly-thinned stand, will materially reduce the rotation period for tie and prop products. The only possible argument for light thinning under these conditions must be based on possible pathological considerations which have introduced a rather puzzling element of study in this particular project.

The rather difficult task of preparing stand tables for the experimental cutting study plots in the Rio Grande Engelmann spruce type, and computing increments for the various periods since establishment of the plots, was undertaken. This work will carry well into February and when completed will add another link to the chain of Engelmann spruce growth statistics which the Region is now forging.

Supervisor Pearce continued with the job of checking and revising the material submitted by the Gunnison Forest in the strip survey growth study of the Engelmann spruce type. The Uncompahgre Forest submitted its final report during the month, which completes this phase of the project so far as present activity by individual Forests is concerned.

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Figure 1. Schematic diagram of the experimental setup for the study of the effect of the initial concentration of the monomer on the polymerization rate.

